



DOE-EM/GJ1274-2006

299-W18-167 (A7649) Log Data Report

Borehole Information:

Borehole: 299-W18-167 (A7649)		Site: 216-Z-1A Crib			
Coordinates (WA St Plane)		GWL¹ (ft): None	GW Date: 03/31/06		
North 135412.566	East 566562.19	Drill Date 01/78	TOC Elevation 676.50	Total Depth (ft) 128.0	Type Cable

Casing Information:

Casing Type	Stickup (ft)	Outer Diameter (in.)	Inside Diameter (in.)	Thickness (in.)	Top (ft)	Bottom (ft)
Steel	2.5	8 3/4	8	3/8	2.5	128

Borehole Notes:

The logging engineer measured the casing stick-up and diameter using a caliper and steel tape. Logging data acquisition is referenced to the TOC. According to the driller's log, contamination was encountered at 55 ft. A "very fine sand" that was moist was reported at this depth.

Logging Equipment Information:

Logging System: Gamma 4E		Type: SGLS (70%) SN: 34TP40587A	
Effective Calibration Date: 03/22/06		Calibration Reference: DOE/EM-GJ1168-2006	
		Logging Procedure: MAC-HGLP 1.6.5, Rev. 0	

Logging System: Gamma 4I		Type: PNLS SN: U1754	
Effective Calibration Date: Not required		Calibration Reference: None	
		Logging Procedure: MAC-HGLP 1.6.5, Rev. 0	

Spectral Gamma Logging System (SGLS) Log Run Information:

Log Run	1	2 Repeat	3 Repeat	4	
Date	04/03/06	04/04/06	04/04/06	04/04/06	
Logging Engineer	Spatz	Spatz	Spatz	Spatz	
Start Depth (ft)	3.0	50.0	56.0	122.0	
Finish Depth (ft)	123.0	65.0	58.0	126.0	
Count Time (sec)	100	200	500	100	
Live/Real	R	R	R	R	
Shield (Y/N)	N	N	N	N	
MSA Interval (ft)	1.0	1.0	1.0	1.0	

Log Run	1	2 Repeat	3 Repeat	4	
ft/min	N/A ²	N/A	N/A	N/A	
Pre-Verification	DEC01CAB	DEC11CAB	DEC11CAB	DEC11CAB	
Start File	DEC01000	DEC11000	DEC11016	DEC11019	
Finish File	DEC01120	DEC11015	DEC11018	DEC11023	
Post-Verification	DEC01CAA	DEC11CAA	DEC11CAA	DEC11CAA	
Depth Return Error (in.)	-1	N/A	N/A	N/A	
Comments	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.	No fine-gain adjustment.	

Passive Neutron Logging System (PNLS) Log Run Information:

Log Run	5	6 Repeat			
Date	04/04/06	04/04/06			
Logging Engineer	Spatz	Spatz			
Start Depth (ft)	50.0	52.0			
Finish Depth (ft)	65.0	60.0			
Count Time (sec)	60	60			
Live/Real	R	R			
Shield (Y/N)	N	N			
MSA Interval (ft)	1.0	1.0			
ft/min	N/A	N/A			
Pre-Verification	DI342CAB	DI342CAB			
Start File	DI342000	DI342016			
Finish File	DI342015	DI342024			
Post-Verification	DI342CAA	DI342CAA			
Depth Return Error (in.)	N/A	- 1			
Comments	None	None			

Logging Operation Notes:

Logging was conducted with a centralizer on each sonde and measurements are referenced to top of casing. Repeat data with the SGLS were acquired at 200 and 500 second counting times to provide additional detail of the highest activity zone.

Analysis Notes:

Analyst:	Henwood	Date:	08/03/06	Reference:	GJO-HGLP 1.6.3, Rev. 0
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Pre-run and post-run verifications for the logging systems were performed before and after each day's data acquisition. The acceptance criteria were met.

A casing correction for 3/8-in.-thick casing was applied throughout the borehole.

SGLS spectra were processed in batch mode using APTEC SUPERVISOR to identify individual energy peaks and determine count rates. Concentrations were calculated with an EXCEL worksheet template identified as G4Emar06.xls using an efficiency function and corrections for casing and dead time as determined from annual calibrations. The passive neutron logging system data are used for qualitative purposes and does not require a calibration.

Results and Interpretations:

²⁴¹Am is detected from 57 and 61 ft. The maximum concentration is measured at approximately 250,000 pCi/g at 57 ft. Gamma rays at approximately 662 and 722 keV were detected that may represent ²⁴¹Am. ¹³⁷Cs emits a 661.62

gamma ray that cannot be distinguished from the 662.40 gamma ray emitted from ^{241}Am . A corroborating energy peak at 722.01 keV is used to establish the presence of ^{241}Am rather than ^{137}Cs . In this borehole the 722.01 keV energy peak is used to determine the ^{241}Am concentration. There appeared to be no residual counts in the 662 keV peak that could be attributed to ^{137}Cs .

^{239}Pu is detected at 57 ft. The maximum concentration is measured at approximately 40,000. An evaluation of ^{239}Pu energy peaks determined the 375.05 energy peak had no significant interferences and is used to calculate concentrations.

Weapons grade plutonium is generally considered to be in approximate proportions of 94% ^{239}Pu , 6% ^{240}Pu , and 0.005% ^{241}Pu . Using these proportions, ^{240}Pu could be expected to be on the order of 2,000 pCi/g and ^{241}Pu at 2 pCi/g.

^{237}Np is detected with the SGLS by measuring a daughter product (protactinium-233 (^{233}Pa)) that emits a prominent gamma ray at an energy of 312.17 keV. ^{233}Pa was detected between at 51 and 52 ft and from 56 to 58 ft. The maximum concentration is approximately 19 pCi/g at a 57 ft depth.

Passive neutron logging was performed in the borehole from 50 to 65 ft. This logging method has been shown to be effective in qualitatively detecting zones of alpha-emitting contaminants from secondary neutron flux generated by the (α ,n) reaction and may indicate the presence of α -emitting nuclides, including transuranic radionuclides, even where no gamma emissions are available for detection above the MDL. The passive neutron signal depends on the concentration of α sources, and also the concentrations of lighter elements such as N, O, F, Mg, Al, and Si that emit neutrons after alpha capture. The passive neutron log indicated a maximum count rate of 3 counts per second (cps) at 57 ft. This count rate can be contrasted with that observed in other boreholes in the 216-Z-1A and 216-Z-12 cribs where the count rates can exceed 2000 cps. Part of the reason for the lower count rate is the lower concentrations of transuranics, thus less alpha activity, relative to other boreholes. However, it is likely the dominant cause is that the Pu does not exist as a fluoride compound. ^{19}F has a much higher capture cross section for alpha particles, compared to other light elements such as oxygen or nitrogen. No prominent peaks associated with alpha capture by fluorine were apparent in the spectra suggesting the isotopes of Pu may be in a nitrate or oxide form in this borehole.

A comparison plot of the 1998 RLS (operated by Waste Management Federal Services NW) spectral gamma data and 2006 SGLS data is included. There is not good agreement in the assays for Pu or Am. Differences in the assays could be the result of the radionuclides existing at activity levels very near their respective MDLs. The assays for ^{233}Pa are very close and the total gamma profile suggests no significant changes since 1998.

The repeat logs all show good repeatability.

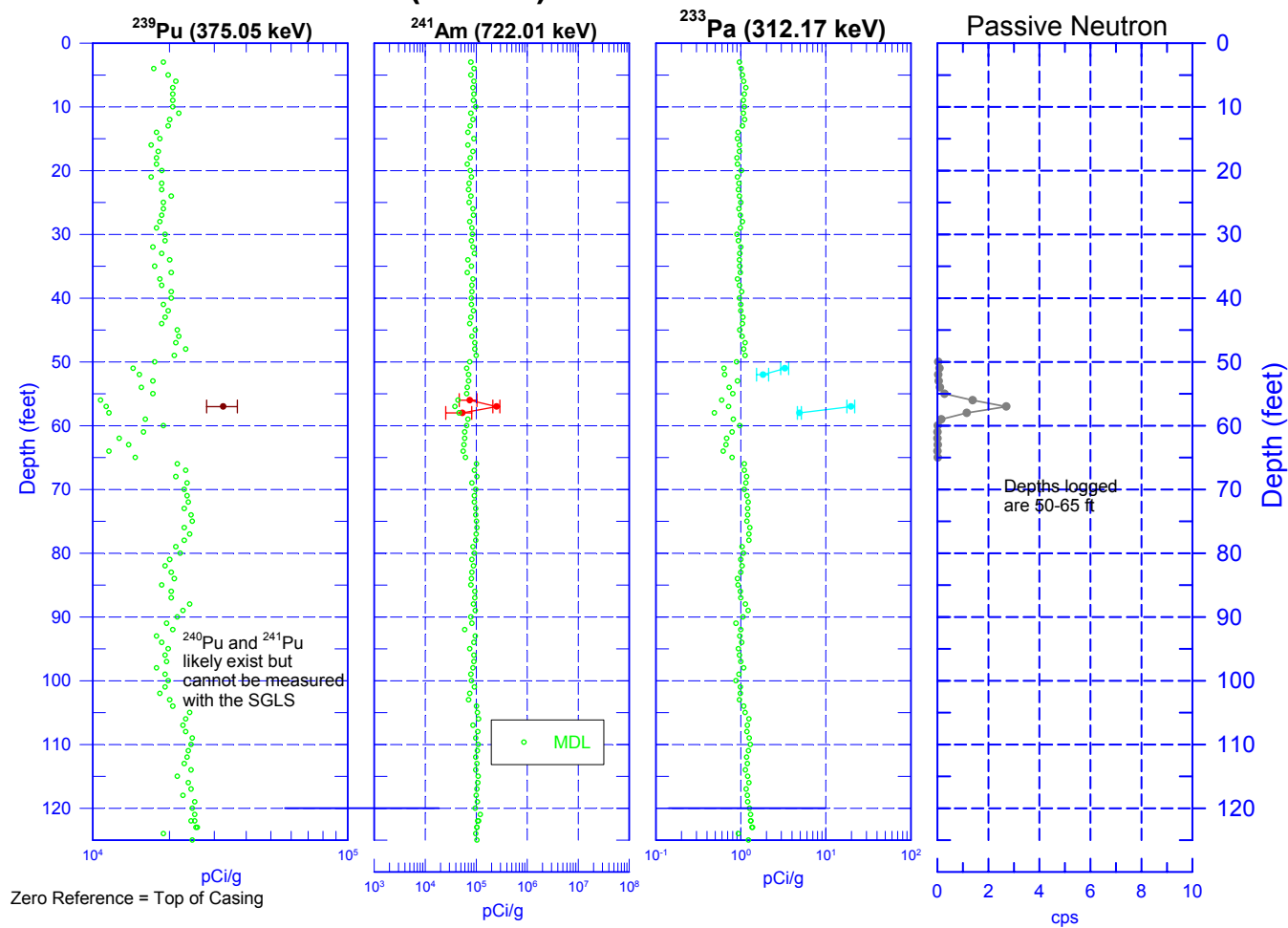
List of Log Plots:

Depth Reference is top of casing
Depth Scale - 20 ft/inch except for repeat logs
Man-Made Radionuclide Plot
Natural Gamma Logs
Combination Plot
Total Gamma & Dead Time
Man-made Radionuclides Repeat Plot
Repeat Section of Natural Gamma Logs
SGLS/RLS Man-made Comparison Plot

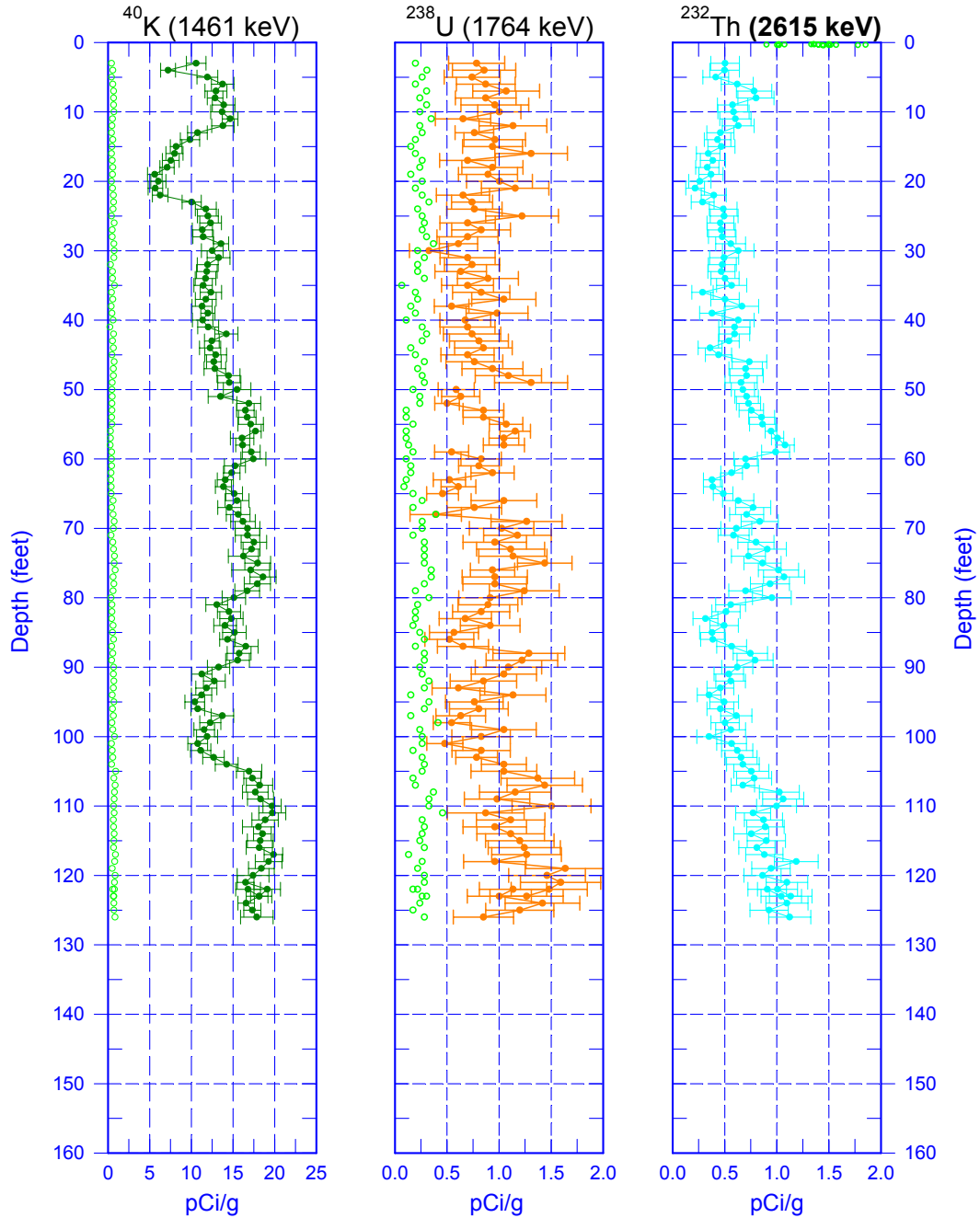
¹ GWL – groundwater level

² N/A – not applicable

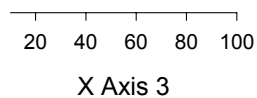
299-W18-167 (A7649) Man-made Radionuclide Plot



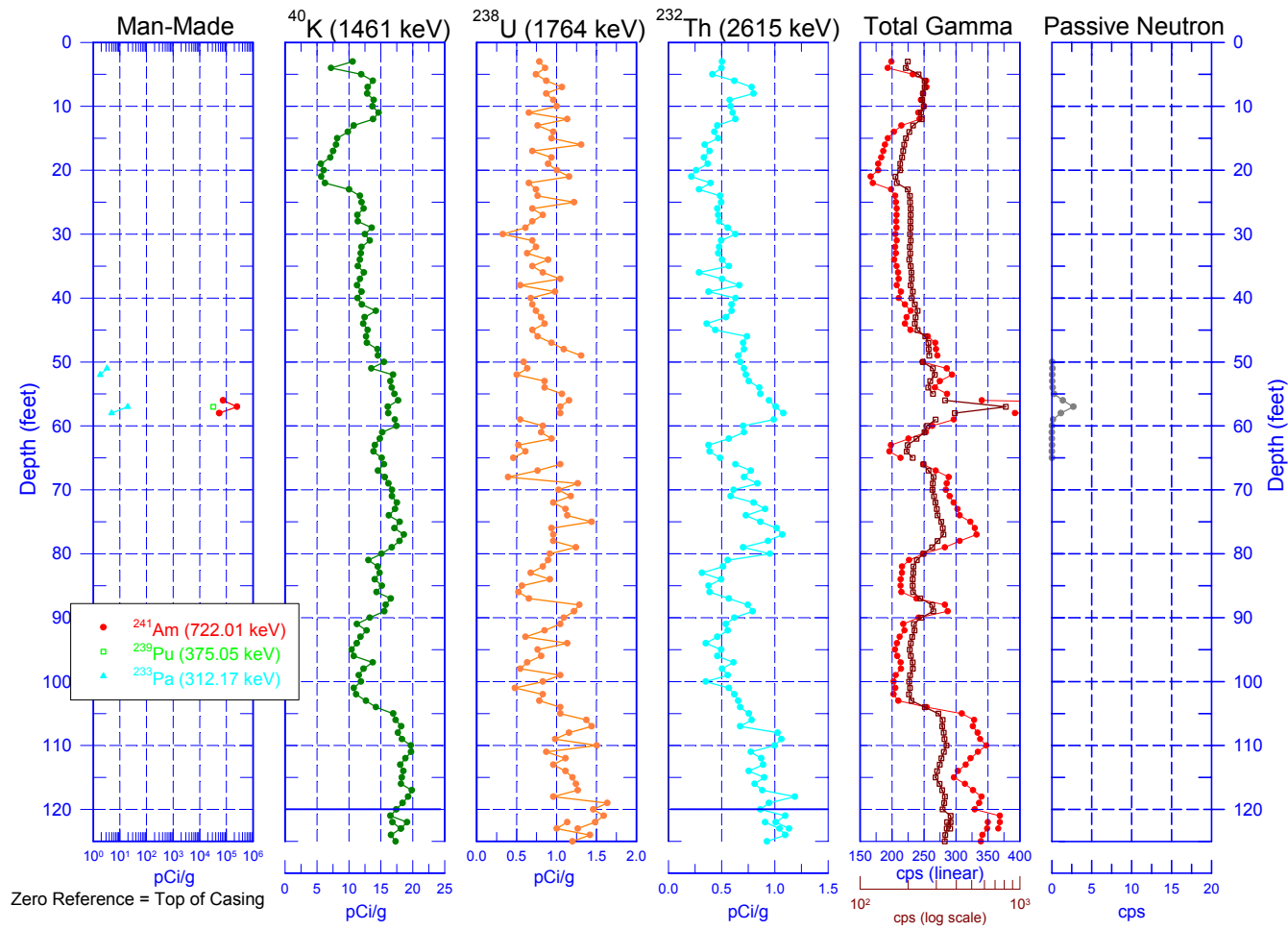
299-W18-167 (A7649) Natural Gamma Logs



Zero Reference = Top of Casing

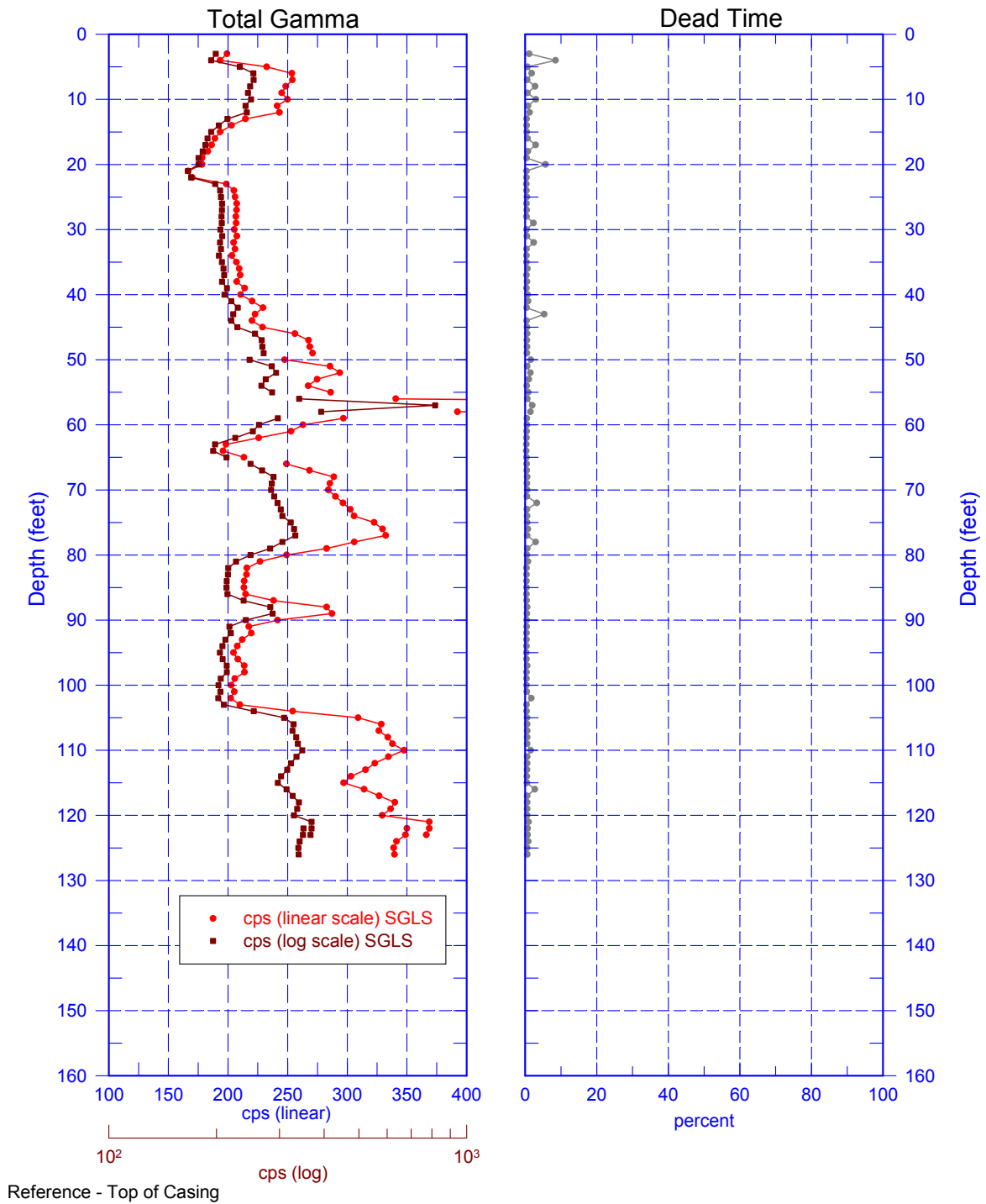


299-W18-167 (A7649) Combination Plot

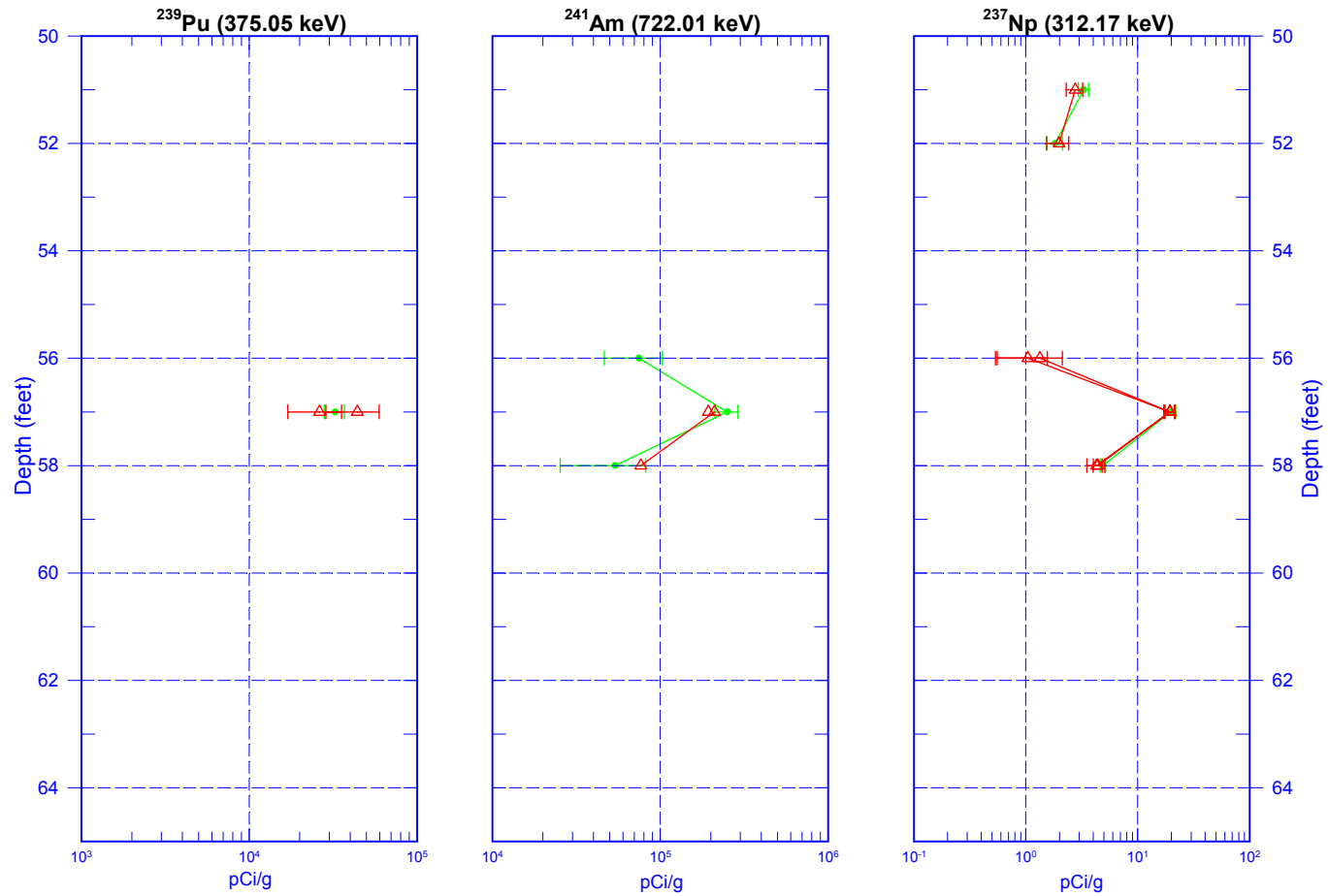


299-W18-167 (A7649)

Total Gamma & Dead Time



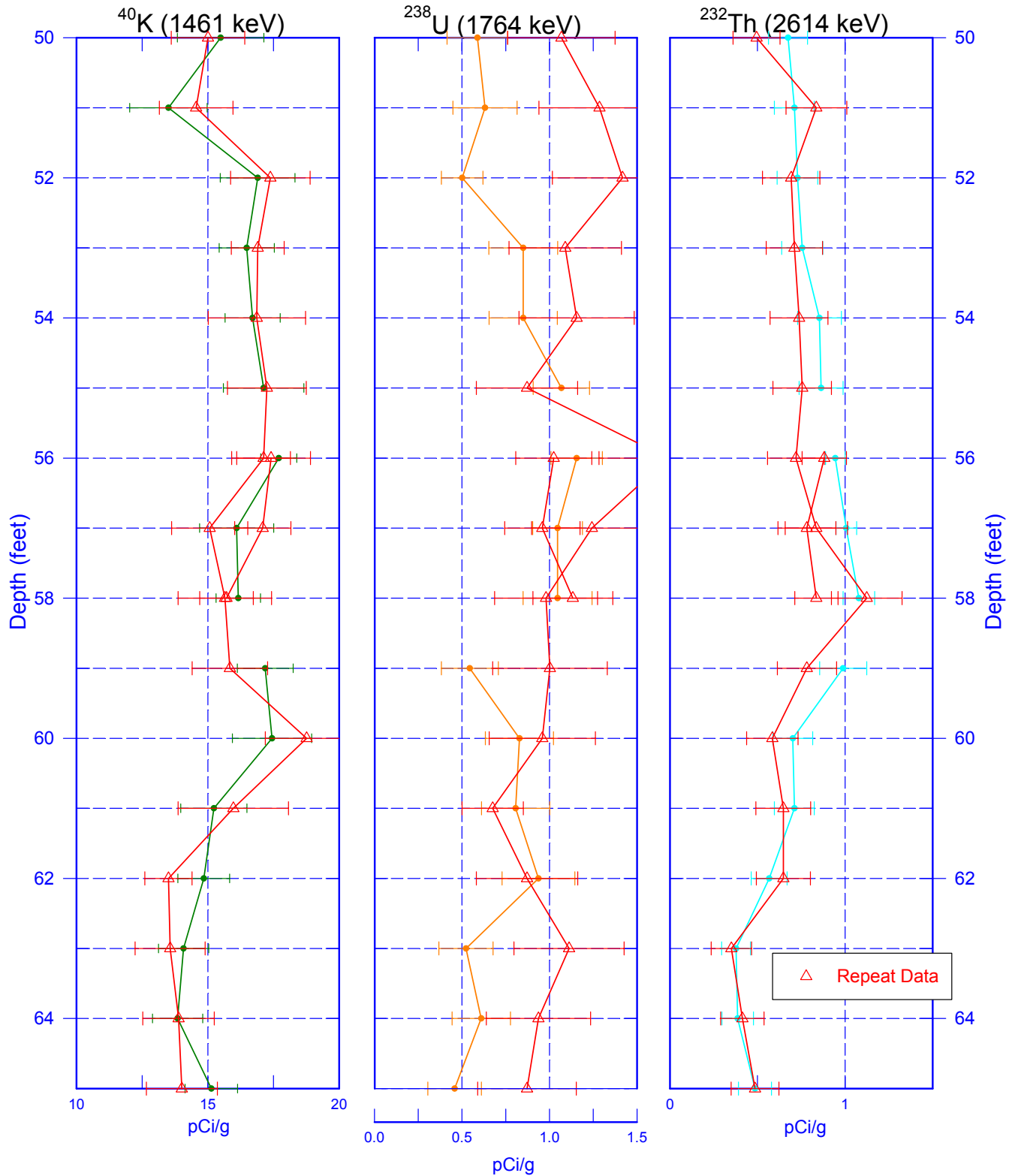
299-W18-167 (A7649) Man-made Radionuclides Repeat Plot



Zero Reference = Top of Casing

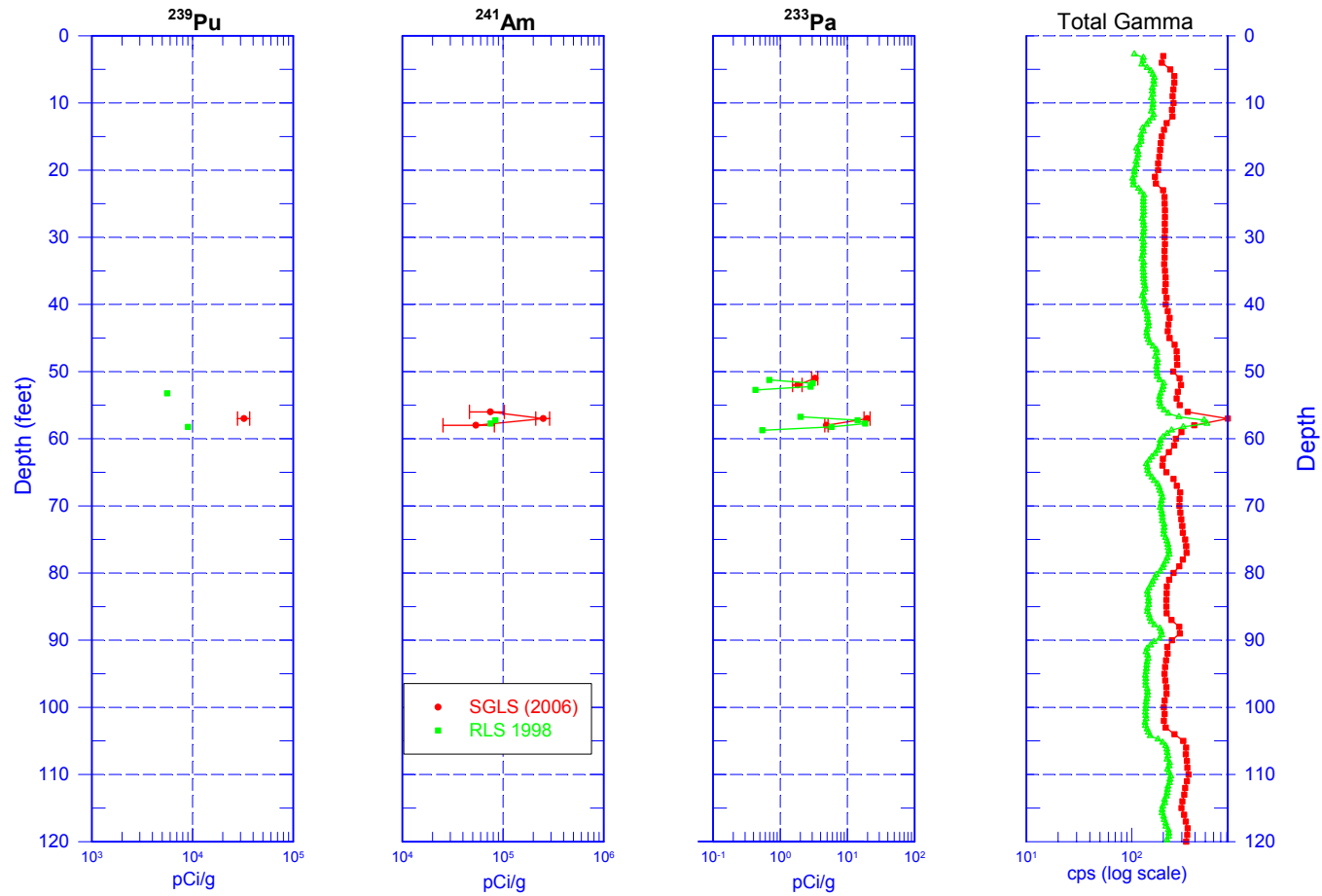
299-W18-167 (A7649)

Repeat Section of Natural Gamma Logs



Zero Reference = Top of Casing

299-W18-167 (A7649) SGLS/RLS Man-made Comparison Plot



Zero Reference = Top of Casing